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Reduced Sickness Absence after a Physical Activity Intervention among Health Care Workers: One-Year Follow-Up of a Randomised Controlled Trial

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Abstract

Background: Health care workers frequently suffer from complaints of musculoskeletal disorders and they are prone to long-term sick leave, as their work involves considerable physical demands.

Objective: To follow-up and evaluate longer term effects measured one year after baseline of "Tailored Physical Activity" (TPA) versus a reference group (REF) in reducing number of self-reported sickness absence days for health care workers.

Methods: In this randomised controlled trial, health care workers (n=54) with musculoskeletal pain in the back or upper body were included and randomised to TPA or REF. All participants participated in individual health counselling (1.5 hours). TPA consisted of both aerobic fitness training and strengthening exercises (three times 50-minute/week during 10 weeks). REF received only health guidance. At baseline and after the intervention period the participants were assessed with a questionnaire and health-related measures.

Results: In the longer term, the TPA showed a significant effect compared to REF in the ability to reduce sickness absence related to troubles in the musculoskeletal system. In TPA 81.5% reported no sickness absence within the last three months compared to 59.3% in REF. Significant improvements were also seen for kinesiophobia ($p<0.01$) and pain ($p<0.01$) from baseline to follow-up.

Conclusion: Results indicate that physical activity interventions can encourage health care workers to be more active and achieve improvements in kinesiophobia and pain intensity, thereby preventing sickness absence.

Keywords: Musculoskeletal disorders; Musculoskeletal pain; Physical activity; Physiotherapists

Trial Registration

ClinicalTrials.gov, number NCT01543984.

Introduction

It is well documented that health care workers have a physical demanding job that involve manual tasks and also handling of patients; together this implies that health care workers have a high risk of long periods of sick leave [1-4].

In addition, their job also involves longer periods of standing and walking and awkward postures, which are potentially hazardous to the musculoskeletal system, and thus potentially causing sick leave [2,5]. In order to ensure that health care workers continue to perform their work and avoid sickness absence, it is important for them to maintain good musculoskeletal health [6]. Franche et al. [7] has shown that pain

related to work has the greatest overall effect on the length of periods with sickness absence and it is relevant to take pain into consideration when designing interventions for health care workers that aims at improving or preserving work ability [7]. This means that focusing on musculoskeletal pain and reduction of pain intensity is one strategy, for prevention of sickness absence among employees with pain in the neck-shoulder or low-back [8].

To this day, interventions involving strengthening exercises have shown to be beneficial for gaining muscle strength and reduce musculoskeletal pain in the back and upper body among different professional groups [9,10]. It has previously been shown that improved functional capacity, as measured by cardiorespiratory fitness, is associated with improving of work productivity [11]. Even so, more knowledge is needed about activities that can prevent work ability and reduce sickness absence for workers with heavy physical work. Therefore our study will generate important knowledge about how preventive physical activities can help health care workers with high physical work demands. The strategy in this trial was to improve the physical capacity of health care workers in order to reduce pain

intensity and thereby prevent musculoskeletal disorders and sickness absence days [2,12]. In addition to this, international recommendations on physical activity for health supports the type of physical activity used in the present intervention [13]. We have a special focus on strengthening exercises for the upper body region. A study of nursing personnel by Souza et al. [14] has previously shown that it is primarily in this body region that the nursing personnel experience problems. Among nursing personnel 48.5% reported problems (pain, tingling/numbness) in the low back, 47.5% in the upper back, 37.2% in the shoulders and 31.9% in the neck [14].

This present paper aimed to evaluate the effects on sickness absence days of 'Tailored Physical Activity' (TPA) compared with a reference group (REF) measured on the longer term. Moreover, to evaluate related secondary outcomes e.g. pain situation, work ability, productivity, kinesiophobia and also outcomes measuring physical capacity. This physical activity intervention including both aerobic fitness training and strengthening exercises training was carefully chosen based on the results from previous research that have shown effective in other occupational groups [9,10,15-17].

It has previously been reported [18] that over a shorter period of three months this physical activity training intervention was a promising initiative for health care workers. In the previous paper health care workers reduced their pain experience, improved work ability and fear of physical movements in relation to pain experience [18]. In the present paper, the longer term effects measured at a one-year follow-up will be reported. We choose to report the same variables as on the shorter term [18] because longer term evaluations give valuable knowledge about the sustainability of outcomes, when health care interventions need to be designed. In the Discussion section in this paper, the results on the longer term will therefore be discussed using the previously published shorter term results as reference, along with other scientific literature.

Methods

Study design

The study was designed as a parallel, randomised, controlled trial with blinded outcome assessors. Participants were primarily evaluated on self-reported number of days of sick-leave. This paper reports the longer term follow-up after one year of the primary outcome together with selected secondary outcomes related to participants' physical capacity, pain situation, work ability, productivity and kinesiophobia.

The trial was conducted in the Sonderborg Municipality in Denmark from February 2012 and ended in April 2014. At the Health Care Centre in Sonderborg were all interventions located and also measurements and tests were conducted in the centre. This means that participants had only up to 30 minutes transportation time from their various workplaces to the training location.

The previously published evaluation of outcomes took place three months after baseline measurement and the follow-up outcome measurement reported in the present paper was conducted one year after baseline measurement [18,19].

Trial protocol was approved by the ethics committee of Southern Denmark (S-20110040), the Danish Data Protection Agency, registered with ClinicalTrials.gov (NCT01356784) and was also published [19]. Complete description of methods has previously been published [19] and also short-term results after three months has been published [18].

Study population and recruitment

Participants were health care workers, e.g. nursing assistants with varying levels of health care training. All participants worked for Sonderborg Municipality in the Department for Health and Social Services e.g. nursing homes or home care (n=560). Inclusion criteria for the study were: (1) performing manual work and (2) have a history of self-reported work-related musculoskeletal pain in back or upper body.

Through internal mail correspondence all employees in the Department for Health and Social Services in Sonderborg were informed about the possibilities for participation. Participants, who volunteered, received written information. This information included an invitation for participation in an information meeting. After the meeting, written informed consent for participation in the study was given by those participants who volunteered for the study and also fulfilled inclusion criteria. Information about included and excluded participants was collected and registrations were made according to the CONSORT statement [20] of included and excluded participants and eligible participants who did not want to participate.

Randomisation

For allocation to TPA or REF participants were randomised according to a randomisation list drawn up by a statistician. The randomisation was in permuted blocks of two and four according to random numbers generated by computer.

An allocation concealment procedure was used for ensuring that group allocation was not known before enrollment in the study. An administration secretary in the department of Health and Social Services in Sonderborg obtained the sealed envelope containing the participants' assigned intervention. The secretary informed the participants about group allocation. Furthermore, the secretary informed participants allocated to the physical activity group about the details for intervention start-up and follow-up testing. The participants who were allocated to the reference group were informed about procedures for follow-up testing. The information was given individually just after the participants received health counselling in the Health Care Centre. The random assignment prevented that neither recruiting personnel nor the personnel at the Health Care Centre had any knowledge about the generation of sequences or the allocation process.

During follow-up testing were participants blinded to the results of baseline assessment. The health care professionals who did the outcome assessment were blinded to participants' baseline assessment and also to allocation.

Interventions

All participants received individual health counselling. The REF group received health guidance only, while the intervention group was offered additional health promotion activities.

Health guidance was a 1.5 hour dialogue with a health supervisor, discussing e.g. participant's well-being or resources. During the counselling conversation, the participants had the opportunity to make a health plan to achieve a healthier lifestyle. The health supervisor encouraged and supported participants to make behavioral lifestyle changes e.g. in relation to physical activity, smoking or other changes for increasing wellbeing in their everyday life.

Tailored physical activity group (TPA)

This group received TPA in training teams (≤ 10 participants/team) in addition to health counselling [18,19]. TPA included a standard combination of 50 minutes aerobic fitness training and strengthening exercises, three times/week over ten weeks during working hours. Physiotherapists supervised the physical activity sessions.

The programmes started with five minutes warm-up followed by aerobic fitness training for 20 minutes, at intensities from 50% to 80% heart rate reserve, progressively developed during the intervention period. On the basis of the participants primary region of musculoskeletal problems (neck and shoulder pain; arm and/or hand pain; lower back pain) the physiotherapists referred participants to one of three standardized strength training programmes. Likewise, the physiotherapists ensured, that the programme was tailored to participants' current pain troubles and training status [21].

The participants had the choice between rowing, ergometer cycling, cross training and stepping for warm-up and aerobic fitness training. The participants consulted the physiotherapists before they chose, because the choice of warm-up activity should take into consideration the participants' current musculoskeletal troubles and also take into consideration their general health situation. For ensuring an optimal training intensity for participants, the HR was monitored during the training sessions.

The programme with strengthening exercises for participants with neck and shoulder pain is made up of five different exercises with dumbbells; one-arm row, shoulder abduction, shoulder elevation, reverse flies and upright row. The programme for participants which have pain primarily in the arm and/or hand region had a programme with five different exercises with dumbbells: front raise, shoulder abduction, reverse flies, shoulder elevation and wrist extension [9,10,15,17,22]. During each training session were three of the five different strengthening dumbbell exercises performed with three sets per exercise in an alternating manner. Shoulder elevation was the only exercise that was performed during each training session. Those participants having pain primarily related to the lower back participated in a programme with specific strengthening exercises corresponding to the strengthening exercises for the upper body. The standardised strengthening exercises for the lower back were exercises activating the rectus abdominis, erector spinae and oblique externus muscles for more than 60% of their maximal voluntary contraction [16,23]. During the intervention period, the training load was progressively increased.

The physiotherapists guided the participants, and they ensured that the training sessions followed the standardized manuals for the project. The participants' programme was individually tailored and the physiotherapists were encouraged to use their professional judgment, so that the activities in the training sessions were matched each participant's current musculoskeletal troubles and health situation.

Outcomes

The primary outcome was the participants' self-reported sickness absence due to musculoskeletal troubles measured after one year. Sickness absence was measured with a question modified from the Nordic Musculoskeletal Questionnaire, "How many days in total have you been on sick leave because of musculoskeletal troubles (aches, pain, discomfort etc.) during the last three months?" (0 days, 1-7 days, 8-30 days, >30 days) [24]. The question, that measure the primary

outcome refers to the three months before the trial starts, while the primary outcome measurement after one year reflects the three months just before the point of measurement, i.e. from six months after the intervention stopped until the point of measurement.

Baseline characteristics and secondary outcomes were collected using questionnaire and health-related, anthropometrical and physical capacity measurements. The specific questionnaire which was developed for this trial consisted primarily of standardized and validated measures.

Trained physiotherapists conducted all objective outcomes measuring. Anthropometric measuring was without shoes and wearing light clothes. Hand-grip strength was measured in kilograms with a digital hand-held dynamometer. During testing of hand-grip strength the participants sat upright on a chair with the safety strap from the dynamometer around the wrist, their test arm was at right angles and their elbow by the side of their body. They were allowed to extend the wrist up to 30°. During testing, the physiotherapists strongly encouraged participants to squeeze with their maximum effort. Three trials were performed and an extra trial was conducted if the squeezed force changed more than three kilograms between the attempts [25].

The Astrand-Rhyming Test is a submaximal aerobic fitness test performed on a cycle ergometer, and this test was used for estimation of aerobic capacity. The participants were cycling 60 rpm at a workload, predetermined to match sex and condition of each participant. Heart rate was measured during the exercise and the test was ended when the participant reached a steady state heart rate. Aerobic capacity was estimated based on Astrands nomogram and adjusted for age and gender, with normalization to body weight [26,27].

Pain during the last 7 days was measured on a Visual Analogue Scale (VAS) using a 100 mm VAS anchored with 'no pain' at 0 mm and 'worst imaginable pain' at 100 mm [28].

Work ability was assessed with a single-item measure. The question was 'Imagine that your work ability is worth 10 points when it is at its best. How many points would you give your present work ability?' The answer was recorded on a numerical rating scale where 0 represents 'not able to work' and 10 represents 'the highest work ability' [29,30].

Work productivity was assessed with a question that was modified from the Work Performance Questionnaire [31], "During the past month, how much did health problems affect your productivity while you were working?" The answer was recorded using a Likert Scale, where 1 represents "A high extent" and 5 represents "Not at all" [32,33].

Kinesiophobia are dysfunctional beliefs about physical activities. They were measured with the Tampa Scale for Kinesiophobia. The scale consists of a 17-item questionnaire to assess fear of (re)injury due to movement. This avoidance behaviour can be one mechanism in sustaining chronic pain disability. Each of the items was provided with a 4-point Likert scale, with scores ranging from "strongly agree" to "strongly disagree" [34,35-37].

Statistical analysis

Differences between TPA and REF in baseline were tested with Pearson's χ^2 for categorical variables, while independent samples t-tests were used for testing of the continuous variables.

Primarily, a difference between TPA and REF in self-reported sickness absence from work due to musculoskeletal complaints was tested with a Pearson's χ^2 . The outcome was dichotomised for analysis

so it indicated whether the participant had no sickness absence (0 days) because of musculoskeletal troubles, or had sickness absence during the previous three months (1-7 days, 8-30 days, >30 days).

Testing for group differences between TPA and REF for secondary outcomes was performed with a linear mixed model, and in addition a paired samples t-test was used for testing of differences between baseline and follow-up within groups.

The intention-to-treat-principle was used, i.e. all randomised participants are included in the analyses with missing values being substituted by carried forward or backwards measured values, leaving a delta-value of null. All results are given as mean (95% CI) or numbers (%). Similarly, mean and change values are reported with 95% CI, with $p \leq 0.05$ considered statistically significant.

All statistical data analyses were performed using IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.

Results

The total number of 54 health care workers from Sonderborg Municipality in Denmark was included in this trial. The flow of participants' progression through the study is shown in Figure 1. At baseline, participants were aged 46.1 (43.6-48.6), with 51 (94.4%) participants being women, and 42 (77.8%) participants were married or cohabitant. Among participants 24 (44.4%) had no training or basic training, 10 (18.5%) had taken short vocational training course, and 19 (35.2%) had taken a medium-term vocational training course. No group differences were found at baseline.

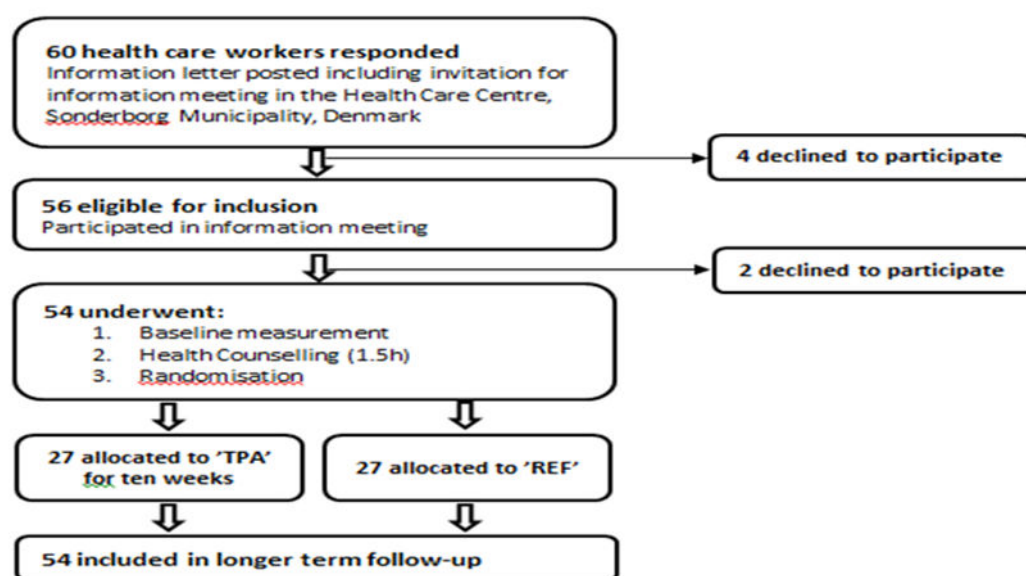


Figure 1: Trial flow diagram of inclusion, randomisation and follow-up. TPA=Tailored physical activity group; REF=reference group.

Sickness absence

At the longer term follow-up after one year, significantly more participants from TPA than REF have had no sickness absence due to musculoskeletal troubles within the last three months (Table 1).

Health and work-related outcomes

Kinesiophobia decreased significantly in TPA relative to REF from baseline to follow-up ($p=0.03$), and a significant decrease from baseline to follow-up was also seen for kinesiophobia for TPA (<0.01) (Table 2). From baseline to follow-up, pain intensity reduced significantly for both TPA and REF. However, for TPA the reduction was twice the reduction for REF. No other significant group differences were found (Table 2).

Discussion

The results from this longer term follow-up in a RCT showed that significantly more health care workers participating in an intervention with 10 weeks of standardised physical activity had no days with sickness absence than was the case with a reference group. Significant

and relevant improvements in favor of TPA were also seen in kinesiophobia and for both groups in pain, while no effect was seen on work ability, productivity or physical capacity measures.

The results add to the evidence and this addition is requested in a systematic review conducted by Schaafsma et al. [34]. In this systematic review [34] of the effectiveness of physical conditioning integrated in a strategy for return to work, it has been concluded that more research is needed. Schaafsma et al. [34] found that the effectiveness is uncertain, e.g. with regards to reduction of sickness absence. The positive effect shown in the present trial may partly be due to the fact that the intervention was executed at the workplace while Schaafsma et al. [34] suggested that execution of the intervention at the workplace may be one component that renders a physical conditioning programme effective. Taken into consideration the results shown both on the shorter and longer term, it may be relevant to combine physical activity interventions with other kind of interventions offering, a multifaceted intervention to enhance effectiveness on work related outcomes [34,35]. However, the results in the present trial does not necessarily underpin that it is crucial to offer multifaceted interventions, because a significant effect was seen on the longer term with respect to important work related outcomes.

	TPA, n=27				REF, n=27		
	Baseline	Follow-up	p-value		Baseline	Follow-up	p-value – group differences
0 days (no (%))	13 (48.1)	22 (81.5)	0.01		13 (48.1)	16 (59.3)	0.41
1-7 days (no (%))	10 (37.0)	3 (11.1)			12 (44.4)	9 (33.3)	
8-30 days (no (%))	3 (11.1)	1 (3.7)			1 (3.7)	0 (0.0)	
>30 days (no (%))	1 (3.7)	1 (3.7)			1 (3.7)	2 (7.4)	
TPA=Tailored Physical Activity Group; REF=Reference Group. Tested with a Pearson's χ^2							

Table 1: Primary outcome: Sickness absence days-one year.

	TPA				REF		
	Baseline	Long term follow-up	p-value		Baseline	Long term follow-up	p-value – group differences
Pain, VAS 0-100 (mm (CI))	47.9 (37.9-57.8)	28.6 (16.4-40.8)	<0.01		38.9 (27.9-50.0)	29.0 (18.5-39.5)	0.03
Work ability, 0-10 (score (CI))	7.3 (6.9-7.8)	7.9 (7.0-8.7)	0.31		8.0 (7.1-8.8)	8.1 (7.2-8.9)	0.42
Productivity, 0-10 (score (CI))	7.5 (6.9-8.1)	7.9 (7.1-8.7)	0.45		8.2 (7.5-8.8)	8.1 (7.2-9.0)	0.92
BMI (kg/m ² (CI))*	31.4 (28.4-34.4)	31.1 (28.0-34.2)	0.12		29.6 (26.8-32.4)	29.2 (26.5-31.9)	0.45
Aerobic capacity (ml/min/kg (CI))*	25.81 (22.5-29.3)	27.11 (24.1-30.0)	0.26		29.61 (25.1-34.1)	29.01 (25.0-33.1)	0.57
Kinesiophobia, TSK-17, 17-68 (score(CI))	26.7 (23.7-29.7)	23.9 (21.6-26.1)	<0.01		27.0 (24.6-29.4)	26.9 (24.1-29.7)	0.90
Grip strength, right (kg (CI))	32.5 (29.4-35.6)	32.7 (29.5-36.0)	0.58		31.2 (27.8-34.6)	30.6 (27.7-33.5)	0.27
Grip strength, left (kg (CI))	30.4 (27.6-33.2)	30.8 (28.0-33.5)	0.56		29.6 (26.5-32.6)	29.1 (26.1-32.1)	0.32
TPA=Tailored physical activity group; REF=Reference Group; VAS=Visual Analogue Scale; BMI=Body Mass Index; CI= 95% confidence interval; n=54. A linear mixed model used for testing of differences between groups and paired samples t-test used for testing of differences within groups.							

Table 2: Secondary outcomes-one year.

This is partly in line with a previous randomised controlled trial on a multifaceted workplace intervention for low back pain in nurses' aides. Rasmussen et al. [35] pointed out the importance of more research on implementation of multifaceted interventions that most likely costs more and are complex to deliver compared to single faceted interventions, e.g. physical conditioning. It is relevant to question the effects of these extra resources however, in the present trial important effects were in fact seen on the longer term of a tailored physical activity intervention.

Previously, at a three-month follow-up [18], no effects on sickness absence were demonstrated in the present trial. This lack of effect could be related to methodological issues with regard to the period of measurement, as described in Andersen et al. (2015). Conversely,

highly significant and substantial reductions in pain intensity and kinesiophobia were seen in the short term. These improvements in the short term can in part explain the longer term effect on sickness absence days, indicated by the present study. Looking at the three time points for evaluation in the protocol for this present RCT [19], the proportions in the physical activity group that report 'no sickness absence days' developed from 48.1% at baseline to 66.7% at short term follow-up [18] and 81.5% at the longer-term compared to the REF with 48.1% at baseline, 55.9% at short-term follow-up [18] and 59.3% at longer-term follow-up. These results could be explained by the fact that sickness absence is a multifaceted outcome influenced by many different factors [36,37]. In relation to the present study, factors such as pain intensity and kinesiophobia may be prerequisites for maintaining working life of health care workers. A systematic review on sick leave,

including a meta-analysis [38], has also shown improvements in pain from workplace interventions for workers with musculoskeletal disorders, and has also shown a reduction in time to return to work, in addition to improvements in functional status.

Besides the improvements in sickness absence days, the study also showed significant improvement in kinesiophobia from baseline to follow-up. No further improvements were evident for TPA compared to REF. On the other hand, it might be over-optimistic to expect that participants would continue improving on health-related outcomes when the intervention had stopped nine months previously.

The present positive results on sickness absence days, pain and kinesiophobia following a single faceted intervention containing strength training, are in line with a previous study [39] where a preventive effect on work ability of a strength training programme was found. The programme was recommended on the short term to employees with musculoskeletal disorders exposed to repetitive and forceful job tasks.

Although the participants had not participated in an intervention during the last nine months, there are still significant improvements in the experience of pain intensity and also of kinesiophobia. These improvements may partly be due to the fact that the causes behind improvements in sickness absences are complex in nature. We are not aware whether participants continued their physical activity after terminations of the interventions, but since the improvements in pain and kinesiophobia were less evident after one year than after three months, they are likely not to have continued. We anticipate that any longer term positive influence on sickness absence days will diminish over time if participants do not continue with physical activity. As a consequence, it does seem to be important to ascertain whether and how the follow-up of physical activity interventions needs to be pursued if the effects are to be maintained. This can only be done optimal by conducting an RCT comparing a group who continues with TPA and a group who does not.

The results of the current study provide a sound basis for recommending, that health care workers perform physical activities for achieving reduced kinesiophobia and pain intensity to reduce sickness absence.

Conclusion

The results of the longer term follow-up in the present randomised controlled trial for health care workers in Sonderborg Municipality demonstrated that a tailored physical activity intervention reduced sickness absence days even in the longer term. Relevant and significant improvements in the pain experience and kinesiophobia were also found for the group that participated in the tailored physical activity intervention.

Declaration of Interest

The authors report no conflicts of interest.

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